

A Gamma Ray Tracking Algorithm for GRETA

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The Gamma Ray Energy Tracking Array (GRETA) [1] is a proposed 4pi Ge detector array. We have developed a gamma-ray tracking algorithm for GRETA which will identify and resolve individual gamma rays from high multiplicity gamma ray events. This algorithm has been tested on a realistic GRETA geometry using Monte Carlo simulated data.

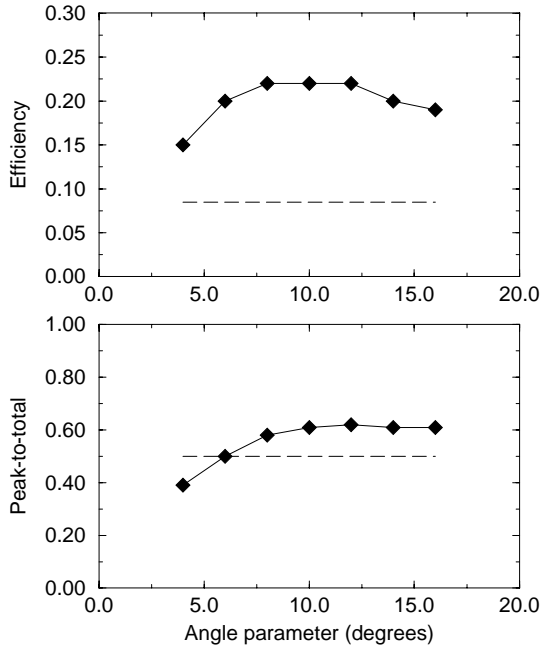


Figure 1: The efficiency and peak-to-total are shown (by the solid line) for a realistic GRETA geometry of 120 close-packed Ge detectors. A position resolution of 2mm is assumed. The simulated data consists of 400 events, where each event is 25 coincident 1.332 MeV gamma-rays. The dashed line is the performance of Gammasphere.

The algorithm works by employing a 3-step procedure: (i) assign interaction points to clusters using an angle parameter (any 2 points

within this angular separation are put in the same cluster); (ii) evaluate the clusters using Compton tracking, and (iii) combine/separate clusters that do not satisfy the Compton tracking criteria in order to recover the maximum number of good gamma rays. Success is gauged by calculating the efficiency and peak-to-total numbers. Figure 1 shows the current results compared with Gammasphere [2]. The efficiency and peak-to-total values are sensitive to both the event multiplicity and the gamma-ray energies, either lower multiplicities and/or lower transition energies lead to higher values for the efficiency and peak-to-total.

The tracking algorithm discussed here should be considered as a first step and the values in Fig. 1 represent a realistic minimum. In principle, for a perfect tracking algorithm even including a realistic geometry, an efficiency of $\sim 50\%$ and peak-to-total of 0.9 for 25 coincident 1.332 MeV gamma-rays is achievable. In the future we will investigate alternative methods to track and identify individual gamma rays using, for example, codes based on neural networks, as well as more “conventional” approaches such as the one discussed in this report. The hope is to achieve efficiencies close to the “theoretical” limit.

References

- [1] M.A. Deleplanque, et al, accepted in NIM A.
- [2] I.Y. Lee, Nucl. Phys A520, 641c (1990).